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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/666,587	09/18/2003	Shuming Nie	50508-1100	1656

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THOMAS, KAYDEN, HORSTEMEYER & RISLEY, LLP
100 GALLERIA PARKWAY, NW
STE 1750
ATLANTA, GA 30339-5948

EXAMINER	
YU, MELANIE J	

ART UNIT	PAPER NUMBER
1641	

DATE MAILED: 12/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/666,587	NIE ET AL.	
	Examiner	Art Unit	
	Melanie Yu	1641	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 November 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7,9-27 and 29-96* is/are pending in the application.

4a) Of the above claim(s) *30-52* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7,9-27,29 and 53-96* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 September 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendments

Applicant's amendment filed November 12, 2004 has been entered.

Claims 8 and 28 are canceled. Claims 30-52 are withdrawn. Claims 1 and 53-58 are amended. Claims 59-96 are new.

Withdrawn Rejections

Rejections under 35 U.S.C. 112 second paragraph of claims 1, 8, 11, 12, and 14-24 and objection to claim 28 have been withdrawn.

Prior art rejections of claims 1-29 under 35 U.S.C. 102(b), 102(e) and 103(a) have been withdrawn.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. Claims 25-27 and 29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. These claims recite a probe attached directly or via a linking compound to a porous substrate. It is unclear whether the attachment is due to the hydrophobic, hydrophilic, or electrostatic interactions as recited in claim 1 or whether the attachment is due to the probe linking to a biomolecule already attached to the porous substrate.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1, 2, 4-6, 9-11, 19, 22, 24, 26, 27, 53-58, 74-77, 79, 81-83, 91, 94, and 96 are rejected under 35 U.S.C. 102(e) as being anticipated by Chee et al. (US 6,544,732).

Chee et al. teach a bead comprising a nanospecies being a semiconductor quantum dot (col. 13, lines 53-60) having a first hydrophobic characteristic (col. 7, lines 40-54) and a second detectable characteristic being a fluorescent characteristic (col. 17, lines 20-30); and a porous material being hydrophobic (col. 7, lines 40-54), silica (col. 3, lines 34-36), and having a plurality of pores (col. 3, lines 34-36), wherein interaction due to the hydrophobicity of the nanospecies and the hydrophobicity of the porous material causes the nanospecies to interact with and become disposed in the pores of the porous material (col. 7, lines 40-54). Chee et al. also teach the first characteristic being a hydrophilic or electrostatic characteristic, wherein both the porous substrate and the nanospecies are hydrophilic (col. 7, lines 40-54) or disposal occurs through electrostatic forces (col. 6, lines 30-40; col. 7, lines 35-41).

With respect to claims 2 and 4, in a preferred embodiment, Chee et al. teach the nanospecies being an antibody (col. 16, lines 54-57).

Regarding claims 5 and 79, Chee et al. teach a mesoporous material by teaching a porous bead as a substrate having size of 100 nm (col. 8, lines 9-17). Therefore the pore sizes must be less than the size of the bead, 100 nm, and the material is mesoporous.

Regarding claims 10, 11, 82 and 83, Chee et al. teach the nanospecies being a semiconductor quantum dot coated with a hydrophobic compound (col. 15, lines 15-17).

With respect to claims 19, 22, 24, 91, 94 and 96, Chee et al. teach the semiconductor quantum dot comprising a core and a cap, wherein the core is CdS or CdSe (col. 15, lines 10-15) and the cap is ZnS or CdS (col. 15, lines 10-15).

Regarding claims 26-27, Chee et al. teach a biomolecule attached indirectly to the porous material via a linking (photocleavable linker) compound and also attached to a fluorophore (col. 19, lines 43-56).

Chee et al. anticipate claims 53-58, Chee et al. by teaching all limitations recited in the claims as disclosed above. The only difference between claims 53-58 and claim 1 is the intended use recited in the preamble. Statements of purpose or the recitation in the preambles of claims 53-58 have not been given patentable weight because it has been held that a preamble is denied the effect of a limitation where the claim is drawn to a structure and the potion of the claim following the preamble is a self-contained description of the structure not depending upon the introductory clause for completeness. *Kropa v. Robie*, 88 USPQ 478 (CCPA 1951).

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 3 and 78 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chee et al. in view of Thayer et al. (US 6,528,323).

Chee et al., as applied to claims 1 and 74, teach a device comprising a hydrophobic silica structure comprising a nanospecies coated with a hydrophobic compound, but fail to teach a metal nanoparticle as the nanospecies.

Thayer et al. teach a gold nanoparticle disposed within a porous substrate and attached to a target analyte (col. 15, lines 19-22), in order to facilitate detection.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include a nanospecies coated with a hydrophobic compound in the device of Chee et al., wherein the nanospecies is a gold particle as taught by Thayer et al., in order to minimize non-specific binding.

4. Claims 7, 59, 60, 68, 71, 73, and 80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chee et al. in view of Girot et al. (US 5,268,097).

Chee et al., as applied to claims 1 and 74, teach a hydrophobic silica structure comprising a hydrophobic semiconductor quantum dot nanospecies, but fail to teach the silica having a hydrocarbon-derivatized surface.

Girot et al. teach a hydrophobic silica porous material having a hydrocarbon-derivatized surface (col. 44, lines 29-31 and 62) in order to stabilize supports and passivate (neutralize) the surface.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the porous silica material of Chee et al., a hydrocarbon-derivatized surface, in order to prevent non-specific binding to the porous material.

With respect to claim 60, Chee et al. teach a mesoporous material by teaching a porous bead as a substrate having size of 100 nm (col. 8, lines 9-17). Therefore the pore sizes must be less than the size of the bead, 100 nm, and the material is mesoporous.

Regarding claims 68, 71, and 73, Chee et al., as disclosed above, teach a semiconductor quantum dot comprising a core made of CdS or CdSe and a cap made of ZnS or CdS.

5. Claims 12-16 and 84-88 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chee et al. in view of Bawendi et al. (US 6,251,303).

Chee et al., as applied to claims 1, 11, 74, and 83 above, teach a structure comprising a hydrophobic silica material and a hydrophobic coated bead comprising a semiconductor quantum dot. However, Chee et al. fail to teach the materials of the hydrophobic coating compound.

Bawendi et al. teach a hydrophobic coated semiconductor quantum dot, wherein the coating includes a hydrophobic compound substantially disposed on the semiconductor quantum dot (col. 3, lines 29-35), wherein the hydrophobic compound is an $O{=}PR_3$ compound, and R is a saturated linear C_4 to C_{18} hydrocarbon (col. 11, lines 16-35), in order to create nanocrystals that are highly luminescent and stable in aqueous solutions, to prevent charge transfer across the region and to maintain the desired isolation between individual quantum dots (col. 6, lines 11-13; col. 7, lines 44-56).

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the device of Chee et al., a hydrophobic coated semiconductor quantum dot with the coatings taught by Bawendi et al., in order to prevent the dissociation from the binding surface and to prevent the degradation of fluorescence.

Regarding claims 15, 16, 87, and 88, Bawendi et al teach the hydrophobic compound being tri-n-octyl phosphine (col. 1, lines 52-55; col. 7, lines 49-56).

6. Claims 25 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chee et al. in view of Polak et al. (US 6,379,622).

Chee et al., as applied to claim 1, teach a device comprising a semiconductor crystal coated with a hydrophobic compound and a substrate being a hydrophobic porous silica material, but fail to teach a probe attached directly to the porous material.

Polak et al. teach a semiconductor nanocrystal attached to a biomolecule, which is directly attached to a porous material, a fluorophore, and a quenching moiety (col. 6, lines 28-33, 47-54; col. 7, lines 32-44), in order to place a reference in close proximity to a fluorescent label and maximize emission intensity.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the device of Chee et al., biomolecules comprising a fluorophore and a quenching moiety attached directly to a porous substrate as taught by Polak et al., in order to prevent fluorescence when concentration of analyte is low.

7. Claims 17 and 89 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chee et al. in view of Efros et al. (US 6,642,538).

Chee et al. as applied to claims 1, 11, 74, and 83 above, teach a structure comprising a semiconductor quantum dot coated with a hydrophobic compound and a hydrophobic porous silica material, but fail to teach the quantum dot coated with stearic acid.

Efros et al. teach a semiconductor nanocrystal (quantum dot) passively coated with stearic acid (col. 4, lines 16-44), in order to serve as a natural tunneling barrier.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the device of Chee et al., a quantum dot coated with stearic acid as taught by Efros et al., in order to provide additional stability to the quantum dot by isolating the surface of the active portion of the quantum dot from the effects of the environment

and prevent the binding substrate from absorbing a majority of the excitation of the fluorescent label.

8. Claims 18 and 90 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chee et al. in view of Damle et al. (Multilayer Langumuir-Blodgett assemblies of hydrophobized CdS nanoparticles by organization at the air-water interface. J. Mater. Chem., 2000, 10, 1389-1393).

Chee et al., as applied to claims 1, 11, 74, and 83 above, teach a structure comprising a semiconductor quantum dot coated with a hydrophobic compound and a hydrophobic silica material, but fail to teach the quantum dot coated with a compound of octyldecyl amine.

Damle et al. teach a semiconductor nanoparticle that may be rendered hydrophobic by immersing the nanoparticles in octadecylamine and creating a lipid film on the nanoparticle (pg. 1389, left col. first paragraph; pg. 1390, right col., second paragraph, first sentence), in order to disperse the particles on the surface of the water. It is noted that the nanoparticle is a semiconductor quantum dot because it is made from a semiconductive material.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the device of Chee et al., a hydrophobic quantum dot coated with a compound containing octadecylamine as taught by Damle et al., in order to provide a hydrophobic coating for stability of the quantum dot and stability of the fluorescence.

9. Claims 20, 21, 23, 92, 93, and 95 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chee et al. in view of Nie et al. (US 6,468,808).

Chee et al., as applied to claims 1, 11, 74, and 83 above, teach a semiconductor quantum dot coated with a hydrophobic compound, but fail to teach the core of the quantum dot selected from a specific group of semiconductive materials.

Nie et al. teach the core of a quantum dot selected from the group consisting of IIB-VIB, IIB-VB, and IVB-IVB semiconductors (col. 3, lines 45-62), in order to preserve the biological activity of the biomolecule.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the device of Chee et al., a quantum dot as taught by Nie et al., in order to create a stable luminescent quantum dot that can retain luminescent properties.

10. Claims 61-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chee et al. in view of Girot et al. further in view of Bawendi et al.

Chee et al. in view of Girot et al., as applied to claim 59 above, teach a device comprising a semiconductor quantum dot coated with a hydrophobic compound and disposed within a hydrocarbon-derivatized hydrophobic silica material due to hydrophobic interactions, but fail to teach the hydrophobic compound.

Bawendi et al., as applied to claims 12-16 above, teach a hydrophobic compound coated on a semiconductor quantum dot being an $O{=}PR_3$ compound, and R is a saturated linear C_4 to C_{18} hydrocarbon (col. 11, lines 16-35), in order to create nanocrystals that are highly luminescent and stable in aqueous solutions, to prevent charge transfer across the region and to maintain the desired isolation between individual quantum dots (col. 6, lines 11-13; col. 7, lines 44-56).

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the device of Chee et al. in view of Girot et al., a hydrophobic coated semiconductor quantum dot with the coatings taught by Bawendi et al., in order to prevent the dissociation from the binding surface and to prevent the degradation of fluorescence.

Regarding claims 64 and 65, Bawendi et al teach the hydrophobic compound being tri-n-octyl phosphine (col. 1, lines 52-55; col. 7, lines 49-56).

11. Claim 66 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chee et al. in view of Girot et al. further in view of Efros et al. (US 6,642,538).

Chee et al. in view of Girot et al. as applied to claims 59 above, teach a structure comprising a semiconductor quantum dot coated with a hydrophobic compound and a hydrophobic porous silica material derivatized with hydrocarbon, but fail to teach the quantum dot coated with stearic acid.

Efros et al. teach a semiconductor nanocrystal (quantum dot) passively coated with stearic acid (col. 4, lines 16-44), in order to serve as a natural tunneling barrier.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the device of Chee et al. in view of Girot et al., a quantum dot coated with stearic acid as taught by Efros et al., in order to provide additional stability to the quantum dot by isolating the surface of the active portion of the quantum dot from the effects of the environment and prevent the binding substrate from absorbing a majority of the excitation of the fluorescent label.

12. Claim 67 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chee et al. in view of Girot et al. further in view of Damle et al. (Multilayer Langumuir-Blodgett assemblies of hydrophobized CdS nanoparticles by organization at the air-water interface. J. Mater. Chem., 2000, 10, 1389-1393).

Chee et al. in view of Girot et al., as applied to claim 59 above, teach a structure comprising a semiconductor quantum dot coated with a hydrophobic compound and a

hydrophobic silica material derivatized with hydrocarbon, but fail to teach the quantum dot coated with a compound of octyldecyl amine.

Damle et al. teach a semiconductor nanoparticle that may be rendered hydrophobic by immersing the nanoparticles in octadecylamine and creating a lipid film on the nanoparticle (pg. 1389, left col. first paragraph; pg. 1390, right col., second paragraph, first sentence), in order to disperse the particles on the surface of the water. It is noted that the nanoparticle is a semiconductor quantum dot because it is made from a semiconductive material.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the device of Chee et al. in view of Girot et al., a hydrophobic quantum dot coated with a compound containing octadecylamine as taught by Damle et al., in order to provide a hydrophobic coating for stability of the quantum dot and stability of the fluorescence.

13. Claims 69, 70, and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chee et al. in view of Girot et al. further in view of Nie et al. (US 6,468,808).

Chee et al., as applied to claim 59 above, teach a semiconductor quantum dot coated with a hydrophobic compound and a hydrophobic silica material derivatized with hydrocarbon, but fail to teach the core of the quantum dot selected from a specific group of semiconductive materials.

Nie et al. teach the core of a quantum dot selected from the group consisting of IIB-VIB, IIB-VB, and IVB-IVB semiconductors (col. 3, lines 45-62), in order to preserve the biological activity of the biomolecule.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the device of Chee et al. in view of Girot et al., a quantum dot as taught by Nie et al., in order to create a more stable luminescent quantum dot that can retain luminescent properties.

Response to Arguments

14. Applicant's arguments and amendments, see pages 2 and 3, filed November 12, 2004, with respect to the rejection(s)of claim(s) 1 and 53-58 under 35 U.S.C. 102(b) and 102(e) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Chee et al. as necessitated by amendment.

Conclusion

No claims are allowed.

15. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melanie Yu whose telephone number is (571) 272-2933. The examiner can normally be reached on M-F 8:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Long Le can be reached on (571) 272-0823. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Melanie Yu
Patent Examiner
Art Unit 1641

LONG V. LE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1600

12/26/09